CLAIMS

WHAT IS CLAIMED IS:

1. A radiopharmaceutical macroaggregate composition for the treatment of abnormal tissue comprising particles having a minimum size of one micron, wherein the particles comprise a metal and one or more radioactive isotopes, and have sufficient radioactivity for locoregional ablation of cells in the abnormal tissue.

2. The composition of claim 1, wherein the radiopharmaceutical macroaggregate composition is paramagnetic.

3. The composition of claim 1, wherein the radiopharmaceutical macroaggregate composition is nonparamagnetic.

4. The composition of claim 1, wherein the metal is iron or gadolinium.

5. The composition of claim 1, wherein the metal is calcium.

6. The composition of claim 1, wherein the one or more radioactive isotopes are selected from the group consisting of Gallium-67 ($^{67}$Ga), Yttrium-90 ($^{90}$Y), Yttrium-86 ($^{86}$Y), Gallium-68 ($^{68}$Ga), Thallium-201 ($^{201}$Tl), Strontium-89 ($^{89}$Sr), Indium-111 ($^{111}$In), Iodine-131 ($^{131}$I), Samarium-153 ($^{153}$Sm), Technetium-99m ($^{99m}$Tc), Rhenium-186 ($^{186}$Re), Rhenium-188 ($^{188}$Re), Copper-62 ($^{62}$Cu), and Copper-64 ($^{64}$Cu).

7. The composition of claim 1, wherein the radiopharmaceutical macroaggregate composition comprises particulates or microspheres.

8. The composition of claim 7, wherein the particulates or microspheres comprise glass.

9. The composition of claim 7, wherein the particulates or microspheres comprise ceramic.

10. The composition of claim 1, wherein the one or more radioactive isotopes emit beta radiations or positrons.

11. The composition of claim 1, wherein the particles comprise a metal and one radioactive isotope.

12. The composition of claim 11, wherein the radioactive isotope is a cation.

13. The composition of claim 11, wherein the radioactive isotope is an anion.

14. The composition of claim 1, wherein the particles comprise a metal and two radioactive isotopes.

15. The composition of claim 14, wherein one or both of the radioactive isotope are cations.

16. The composition of claim 14, wherein one or both of the radioactive isotope are anions.

17. The composition of claim 14, wherein one of the radioactive isotopes is Holmium-166 ($^{166}$Ho).

18. The composition of claim 1, wherein the particles further comprise Phytate.

19. The composition of claim 10, wherein the particles further comprise Phytate.

20. The composition of claim 14, wherein the particles further comprise Phytate.

21. The composition of claim 1, wherein the ratio of radioactive isotopes to metal is about $10^6$:1.

22. The composition of claim 1, wherein the particles are biodegradable.

23. The composition of claim 1, wherein the size of the particles is from about 5 to about 50 microns.

24. A method for the locoregional treatment of abnormal tissue, comprising administering a radiopharmaceutical macroaggregate composition to a subject in the region of the abnormal tissue, wherein the radiopharmaceutical macroaggregate composition comprises particles having a minimum size of one micron, wherein the particles comprise a metal and one or more radioactive isotopes, and have an effective amount of radioactivity for locoregional ablation of cells in the abnormal tissue.

25. The method of claim 24, wherein the subject is human.

26. The method of claim 24, wherein the one or more radioactive isotopes are selected from the group consisting of Gallium-67 ($^{67}$Ga), Yttrium-90 ($^{90}$Y), Yttrium-86 ($^{86}$Y), Gallium-68 ($^{68}$Ga), Thallium-201 ($^{201}$Tl), Strontium-89 ($^{89}$Sr), Indium-111 ($^{111}$In), Iodine-131 ($^{131}$I), Samarium-153 ($^{153}$Sm), Holmium-166 ($^{166}$Ho), Technetium-99m ($^{99m}$Tc), Rhenium-186 ($^{186}$Re), Rhenium-188 ($^{188}$Re), Copper-62 ($^{62}$Cu), and Copper-64 ($^{64}$Cu).

27. The method of claim 24, wherein the metal is iron.

28. The method of claim 24, wherein the metal is gadolinium.

29. The method of claim 28, wherein the radiopharmaceutical macroaggregate composition comprising gadolinium is exposed to neutron irradiation for the locoregional treatment of abnormal tissue.

30. The method of claim 24, wherein the radiopharmaceutical macroaggregate composition is used in Selective Internal Radiation Therapy (SIRT).

31. The method of claim 24, wherein the radiopharmaceutical macroaggregate composition is paramagnetic.

32. The method of claim 31, wherein the paramagnetic properties of the radiopharmaceutical macroaggregate composition are used to measure the geographic distribution and derive radiation dosimetry of the radioactive composition.

33. The method of claim 31, wherein the paramagnetic properties of the radiopharmaceutical macroaggregate composition is used for local hyperthermia therapy.

34. The method of claim 31, wherein magnetic resonance imaging (MRI), Positron Emission Tomography (PET), ultrasonography, or high resolution gamma scintigraphy is used to measure the spatial and temporal profiles of the radioactive composition.

35. The method of claim 31, wherein a Computed Tomography (CT) scanner is used to localize the radioactive composition.

36. The method of claim 24, wherein the metal is calcium.

37. The method of claim 36, wherein a Computed Tomography (CT) scanner or ultrasonography is used to localize the radioactive composition.

38. The method of claim 24, wherein the particles further comprise Phytate.

39. The method of claim 24, wherein the radiopharmaceutical macroaggregate composition is administered by injection.

40. The method of claim 39, wherein the injection is intratumoral, intravenous, intravascular, intraparenchymal, intraarterial, intracavitary, intra-pleural, intraperitonal, or intrathecal.

41. The method of claim 24, wherein the abnormal tissue is a neoplasm.

42. The method of claim 41, wherein the neoplasm is a tumor.

43. The method of claim 42, wherein the radiopharmaceutical macroaggregate composition is administered directly into the tumor by injection.

44. The method of claim 24, wherein the abnormal tissue is synovial tissue.

45. A radiopharmaceutical macroaggregate composition for the treatment of abnormal tissue comprising particles having a minimum size of one micron, wherein the particles comprise a metal and one or more radioactive isotopes, and have sufficient radioactivity for locoregional ablation of cells in the abnormal, produced by a process comprising the steps of:

(a) mixing one or more radioactive isotopes with a metal chloride;

(b) adding an alkaline to the mixture of part a to precipitate the radioactive isotopes with the metal to form the particles;

(c) separating the precipitated particles from any remaining soluble radioactive isotopes from the particles; and

(d) isolating the radioactive particles.

46. The process of claim 45, wherein the metal chloride is selected from the group consisting of ferric chloride ($FeCl_3$), calcium chloride ($CaCl_2$), and gandolinium chloride ($GdCl_3$).

47. The process of claim 45, wherein the alkaline is sodium hydroxide or ammonium hydroxide.

48. A radiopharmaceutical macroaggregate composition for the treatment of abnormal tissue comprising particles having a minimum size of one micron, wherein the particles comprise a metal and one or more radioactive isotopes, and have sufficient radioactivity for locoregional ablation of cells in the abnormal, produced by a process comprising the steps of:

(a) adding an alkaline to a metal chloride to form a precipitate;

(b) mixing one or more radioactive isotopes with the precipitate of part (a) to allow the radioactive isotopes to adsorb to the precipitate and generate a radioactive precipitate;

(c) separating the radioactive precipitate of part (b) from any remaining soluble radioactive isotopes; and

(d) isolating the radioactive precipitate.

49. The process of claim 48, wherein the metal chloride is selected from the group consisting of ferric chloride ($FeCl_3$), calcium chloride ($CaCl_2$), and gandolinium chloride ($GdCl_3$).

50. The process of claim 48, wherein the alkaline is sodium hydroxide or ammonium hydroxide.

51. The process of claim 48, wherein the radioactive precipitate of part (b) is separated from any remaining soluble radioactive isotopes by centrifugation.

52. A method of acupuncture therapy for an acupuncture-responsive condition, comprising administering a radiopharmaceutical macroaggregate composition into one or more acupuncture points of a subject, wherein the radiopharmaceutical macroaggregate composition comprises particles having a minimum size of one micron, wherein the particles comprise a metal and one or more radioactive isotopes, and have an effective amount of radioactivity to enhance the acupuncture therapy.